



Philosophical Transactions

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*A Letter written to Dr. John Wallis by Mr. Henry Philips,
containing his Observations about the True
Time of the Tides.*

WORTHY Sir, Being desired by Mr. O. to give in, what informations I could, concerning the *Tides*, I have made bold to present this Paper to your Consideration; which though it have little or no relation to your more curious Philosophical Experiments, yet, I hope, will be of very good use for the finding out the *True time* of the *Tides* at all times of the *Moone*, which is (I conceive) of as great concernment, as any thing in the Motion of the *Tides*.

For, this *time* of the *Tides*, though it be a very necessary thing to be known, yet is very rudely and slightly reckoned up by most Seamen and Astronomers; most of them reckoning, as if the *Moone* being upon such a set point of the *Compass* (as the *Seaman* calls it) or so many houres past the *Meridian* (as the *Almanack-Makers* reckon) it were *High-Tide* in such and such a Port at all times of the *Moone*. And thus they reckon the *Tides* every day to differ constantly 48 *m*. As for instance; A *South-West* *Moone* makes a full Tide at *London*, that must be understood, that it is *High-Tide* at *London* when the Moon is three hours past the *Meridian*. Now this is true indeed at the *New* and *Full* Moon, but not at other times of the *Moone*, which few take any notice of: only Mr. *Booker* had wont to give this *Ca-veat*, that about the *first* and *last* quarters of the *Moone*, the *Neap-tides* did not flow so long as the *Spring-tides* by one point of the *Compass*; but he gives no rule to proportion the difference.

But observing this more narrowly, I find, that at *London* the *Tides* fall out at the least *two* points, that is, one hour and an half sooner, in the *Quarters* than in the *New* and *Full* *Moone*. Now this being a very considerable difference of time, which might very well make many Seamen and Passengers to lose their *Tides*, I set my self to watch this difference of the time of the *Tides*, and to find out some *Rule*, how to proportion the time of the *Tides* between the *Spring-tides* and the *Neap-tides*, and I found by many trialls, that the *true time* of the *Tides* might be found

our

out to be somewhat shorter and shorter, from the *New* and *Full* Moone unto the *Quarters*; yet not in an *equall* manner, neither *gradually* decreasing from the *New* and *Full* Moone untill the *Quarters*; but rather, that there was some little difference of alteration both at the *New* and *Full* Moones, and also at the *Quarters*; and that the greatest difference fell out in the midst between them, agreeing very well to a *Circular* proportion, after this manner: (See Fig. 5.)

First, Divide a *Circle* into 12 Equal parts, or hours, according to the Moones motion or distance from the Sun, from the *New* Moone to the *Full*.

Secondly, Let the *Diameter* of the Circle be divided into 90 parts or min. that is, according to the time of the difference of Tides between the *New* or *Full* Moone, and the *Quarters*; which is one hour and an halfe.

Thirdly, Make *perpendicular* lines cross the *Diameter* of the Circle, from hour to hour.

Fourthly, Reckon the time of the Moones coming to the *South* in the circumference of the Circle, and observe the *Perpendicular-Line*, that falls from that point upon the *Diameter*; and the proportionall *Minutes*, cut thereby, will shew, how many *Heures*, or *Minutes* are to be subtracted from the time of High-tides at the *New* and *Full* Moone, that so you may have the true time of the *Tides* that present day.

For *Example*; At *London*, on the day of *New* and *Full* Moone, it is High-Tide at *London* at 3 of the Clock, that is, when the Moone is three hours past the *Meridian*: and so by the *Common Rule*, the *Moone* being about four dayes old, it will be *South* about three of the Clock, and it will be High-tide three houres afterwards, that is, at 6 of the Clock. But now by this *Rule*, if you count this time of the *Moones* coming to the *South* in the *Circumference*, the *perpendicular-line*, which comes from 3 to 9, cuts the *Diameter* in the halfe, at 45 min. which shews, that so much is to be abated from the time of High-tide in the *New* and *Full Moones*; So that it is High-tide 45 min. before 6 of the Clock, that is, at 5. hours 15 min. and not at 6 of the clock, according to the *common-Rule*.

The like you may do for any other Port or place, knowing the
time

time of High-water at the *New* and *Full* Moon in that place : And you may do it the more readily, if you set down the time of High-water at the *New* and *Full* Moon under the *Diameter*, as I have done for *London*, where it is high-tide at III. of the clock. So that when the Moon is South at III. of the clock, the perpendicular cuts the *diameter* at II. hours 15. m. which added to the time of the South-ing makes it V. hours 15. m. and so when the Moon is South at IX. of the clock, by adding 2 h. 15 m. you have the time of high-water, which is XI. of the clock and 15 m.

And thus you may easily make a *Table*, which by the South-ing of the Moon, shall readily tell you the time of High-tide at any time of the Moon, as I have done here for *London*: To which all other places may be reduced to correspond.

Moon South		Tide <i>London</i>		Moon South		Tide <i>London</i>		Moon South		Tide <i>London</i>		Moon South		Tide <i>London</i>	
H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.
XII	03	0		III	05	15		VI	07	30		IX	011	15	
	103	9			105	21			107	41			1011	29	
	203	18			205	27			207	52			2011	43	
	303	27			305	33			308	4			3011	57	
	403	36			405	40			408	14			4012	10	
	503	45			505	46			508	25			5012	24	
I	03	54		IV	05	52		VII	08	36		X	012	37	
	104	2			105	59			108	48			1012	50	
	204	9			206	6			209	0			201	3	
	304	16			306	13			309	13			301	16	
	404	23			406	20			409	26			401	29	
	504	30			506	28			509	39			501	42	
II	04	37		V	06	36		VIII	09	53		XI	01	54	
	104	44			106	44			1010	6			102	3	
	204	50			206	53			2010	20			202	16	
	304	57			307	2			3010	33			303	27	
	405	3			407	11			4010	47			402	38	
	505	9			507	20			5011	1			502	49	

A Table of the time of High Tide for this present year *Anno 1668.*
London-Bridge : where M. denotes Morning, and P. Afternoon.

Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Octo.	Nov.	Dec.
H. M.	I. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.
1 12	2 P 13	1 P 49	P 63	P 23	4 18	4 30	5 P 5	5 54	6 36	8 18	8 36
2 1 P 2	3 11	2 45	3 57	4 44	5 14	5 59	5 32	6 37	7 27	9 20	9 33
3 2 31	3 56	3 29	4 22	4 39	5 20	5 56	2 7	23 8	32 10	24 10	32 32
4 3 37	4 30	4 8	4 35	5 11	5 48	5 52	6 39	8 28	9 43	11 30	11 36
5 4	5 14	4 40	5 24	5 40	6 18	6 23	7 25	9 41	10 54	12 31	12 4
6 4 57	5 29	5 9	5 55	6 12	6 54	7 18	28 11	2 12	3 M	31 M	40
7 5 26	5 58	5 38	6 30	6 49	7 37	7 47	9 43	12 24	M 3	1 32	1 43
8 5 55	6 30	6 9	7 13	7 32	8 27	8 46	11 7	M 24	1 10	2 27	2 37
9 6 2	7 11	6 49	8 5	8 21	9 27	9 57	12 30	1 35	2 9	3 18	3 28
10 7 5	7 59	7 32	8 58	9 18	10 39	11 19	M 30	2 34	3 14	4 24	4 10
11 7 47	8 53	8 28	9 58	10 19	11 53	12 46	1 48	3 24	4 45	5 37	5 41
12 8 3	9 58	9 28	11 2	11 26	1 16	M 46	2 53	4 6	4 23	5 8	5 10
13 9 33	1 7	10 33	12 6	12 34	1 M 16	2 6	3 45	4 39	4 57	5 37	5 37
14 10 16	12 16	11 40	M 6	M 34	2 27	3 15	4 24	5 11	5 27	6 6	6 4
15 11 47	M 16	12 44	1 10	1 44	3 33	4 44	5 56	5 41	5 59	6 42	6 35
16 12 54	1 18	M 44	2 13	2 50	4 22	4 41	5 25	6 14	3 34	7 21	7 12
17 M 54	2 18	1 44	3 9	3 45	5 15	5 55	5 54	6 54	7 16	8 57	8 58
18 1 56	3 8	2 37	4 34	3 36	5 24	5 43	6 29	7 40	8 68	9 56	9 49
19 2 50	3 49	3 27	4 45	5 16	6 8	6 15	7 11	8 34	8 57	9 54	9 55
20 3 36	4 24	4 13	5 23	5 53	6 44	6 53	8 4	9 35	9 54	10 58	11 9
21 4 13	4 57	4 50	6 36	3 33	7 25	7 35	9 0	10 40	10 55	12 9	12 30
22 4 44	5 30	5 26	6 48	7 17	8 16	8 28	10 4	11 43	11 58	1 P 17	1 P 52
23 5 13	6 56	4 7	42 8	8 9	7 9	7 27	11 1	12 44	12 59	2 26	2 2
24 5 41	6 48	6 18	38 9	0 10	10 10	10 33	12 16	1 P 42	2 P 1	3 27	3 58
25 6 13	7 46	7 48	0 35	9 58	11 12	11 32	1 P 16	2 34	2 58	4 17	4 41
26 6 58	8 53	8 53	10 44	10 58	12 18	12 48	2 12	3 32	3 48	4 59	5 15
27 7 49	10 10	10 2	11 47	12 1	1 P 21	1 P 49	3 14	4 4	4 32	5 36	5 47
28 8 5	11 28	11 12	12 49	1 P 2	2 19	2 43	3 43	4 15	5 11	6 14	6 19
29 10 16	12 43	12 20	1 47	2 23	3 11	3 27	4 18	5 18	5 48	6 55	7 0
30 11 44	1 P 21	2 28	2 55	3 54	4 16	4 30	5 52	6 31	7 43	7 45	
31 1 P 2	2 16	3 40	4 37	5 21	7 21					8 26	

These things I have found to fall out right at *London* for many years, and so I suppose they may in other places. If the difference be not so much between the Neap-tides and Spring-tides in other places, the Diameter must be divided into fewer parts.

As for the highest Tides to happen two or three days after the full Moon, I have not made much observation of it, and see little reason for it, but the time thereof agrees here with. And high Spring-tides are not alwayes alike; this year I have not observed any. I should be glad to hear, how these rules hold in other places, that so this *true time* of the Tides may be more punctually known.